Spot Safety Project Evaluation

Project Log # 200702021

Spot Safety Project # 02-00-228

Spot Safety Project Evaluation of the
"Vehicle Entering When Flashing" Sign and Overhead Flasher
At the Intersection of NC 43 and SR 2241 (Ivy Road)
Pitt County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ 12-19-2007
Jason B. Schronce Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-00-228 – The Intersection of NC 43 and SR 2241 (Ivy Road), also known as Cox Crossing, in Pitt County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a "Vehicle Entering When Flashing" Sign and Overhead Flasher for the NC 43 approaches of the subject intersection. Constant red indication flashers were also installed on the SR 2241 intersection approaches. In the study before period, NC 43 and SR 2241 were both two-lane facilities at the subject intersection with no turn lanes and speed limits of 55 mph. These roads intersect at a skewed angle. The subject location is a crossroads type intersection, which is controlled by stop signs on SR 2241 (Ivy Rd). NC 43 was widened to include left turn lanes at this intersection in the first quarter of 2005, while the countermeasure being evaluated remained active.

The original statement of problem was the motorists' behavior of focusing so intently on the poor sight distance that they fail to notice oncoming traffic from the opposite direction. This has yielded a significant pattern of angle collisions including a fatality that occurred on March 20, 2000.

The initial crash analysis was completed from November 1, 1996 to October 31, 1999 with fifteen (15) reported crashes, eleven (11) of which were Angle Crashes. The final completion date for the improvement at the subject intersection was on May 30, 2002 with a total cost of $20,000.00.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from May 1, 2002 to June 30, 2002. The before period consisted of reported crashes from May 1, 1997 through April 30, 2002 (5 years) and the after period consisted of reported crashes from July 1, 2002 through June 30, 2007 (5 years). The ending date for this analysis was determined by the date of available crash data at the time of analysis.

The after period was further separated by the installation of left turn lanes on NC 43 in the first quarter of 2005. "After 1" represents no turn lanes from July 1, 2002 through December 31, 2004 and "After 2" consists of reported crashes with turn lanes on NC 43 from January 1, 2005 through June 30, 2007.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note Angle collisions and Ran-off Roadway crashes resulting from the avoidance of an angle collision are the target crashes for the applied countermeasure.

Treatment Information			
	Before (5 yrs)	**After 1 (2.5 yrs)**	**After 2 (2.5 yrs)**
Total Crashes	24	10	12
Total Crashes / Year	4.80	4.00	4.80
Total Severity Index	11.02	2.48	6.55
Target Crashes	21	6	12
Target Crashes / Year	4.20	2.40	4.80
Target Crash Severity Index	11.39	2.08	6.55
Volume	9,460	9,510	9,510
Injury Crash Summary			
Fatal injury Crashes	1	0	0
Class A injury Crashes	1	0	0
Class B injury Crashes	2	1	2
Class C Injury Crashes	10	1	7
Total Injury Crashes	14	2	9

Table 1

Intersection Analysis Both Countermeasures			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total crashes	24	22	- 8.33 %
Total Severity Index	11.02	4.70	- 57.35 %
Target Crashes	21	18	- 14.29 %
Target Crash Severity Index	11.39	5.52	- 51.54 %

Table 2

The naive before and after analysis at the treatment location with countermeasures combined (from *Table 2*) resulted in an 8 percent decrease in Total Crashes, a 14 percent decrease in Target Crashes, and a 57 percent decrease in the Total Severity Index. The before period ADT year was 2000 and the after period ADT year was 2004.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in an 8 percent decrease in Total Crashes and a 14 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and

Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the major portion of crashes at the intersection in the before period (19 of 24) were the result of a vehicle unsuccessfully attempting to cross NC 43 from SR 2241. After the "Vehicle Entering When Flashing" Sign and Overhead flasher installation, this pattern remains as the denoting crash pattern of the intersection, 18 of 22 after period crashes resulted in angle collisions.

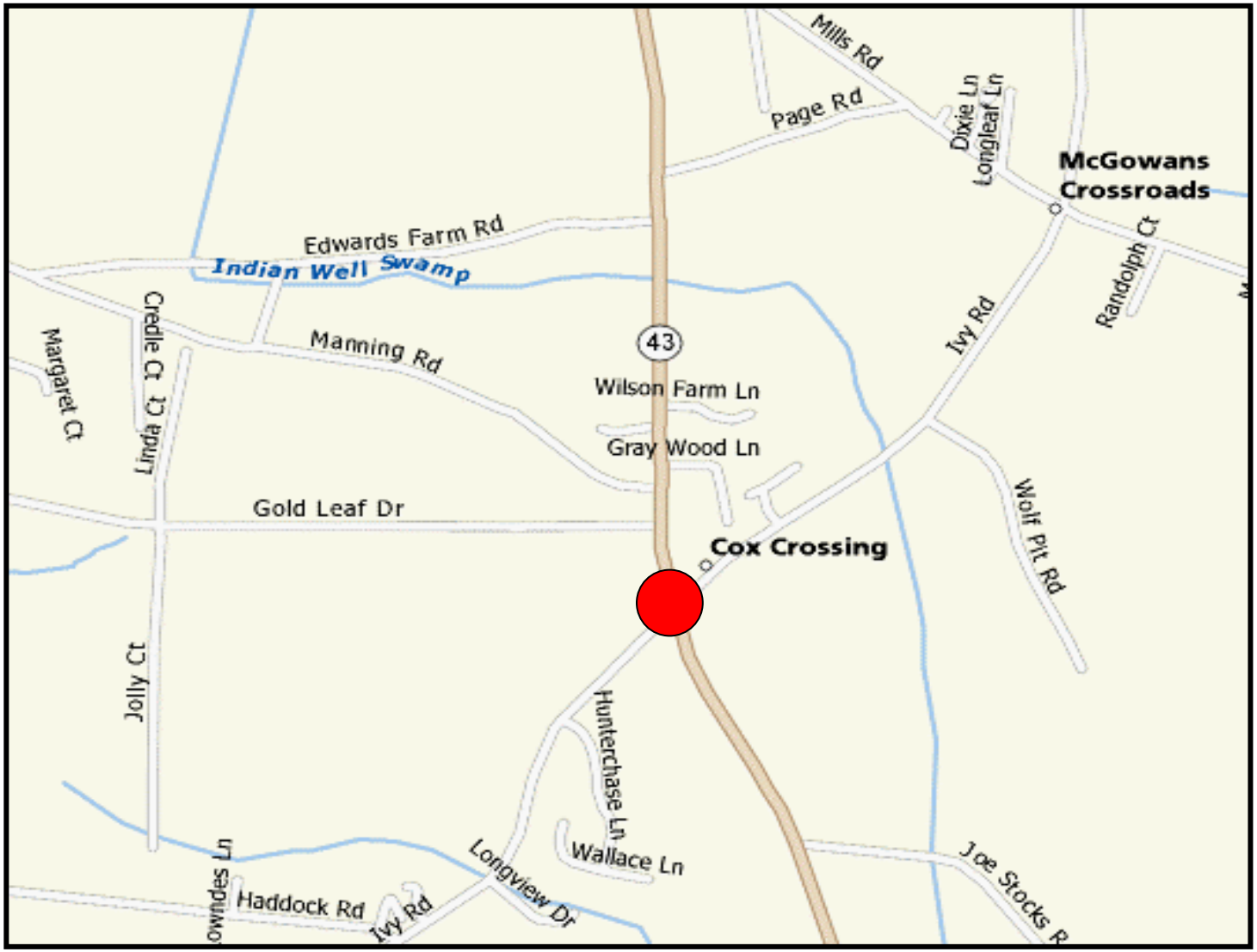
From *Table 1,* Target crashes at this intersection appear to have had a reverse affect after the turn lanes were installed during the after period. This could be accounted for by the widening of the intersection and that vehicles must take additional time to cross NC 43 or that the turn lanes have reduced sight distance due to queuing of left turning vehicles. In any case, the intersection has once again returned to the same amount of crashes per year (4.80) with both countermeasures operational as existed in the before period. We conclude that the intersection as a whole has shown minimal improvement over the naïve crash analysis period.

The calculated benefit to cost ratio for this project is 54.37 considering total crashes. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance and utility costs. The high b-c ratio results from zero fatalities or "A" class injuries during the after period.

Please see the attached *Treatment Site Photos*. Photos are provided for all approaches to the treatment intersection and sight distance to the south, although the configuration of NC 43 shown is different from the configuration that was analyzed for part of this study, as explained in the *Project Background* section.

As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of intersection.

Location Map
Pitt County
Evaluation of Spot Safety Project # 02-00-228



Location: Intersection of NC-43 and SR 2241 (Ivy Road)
Also known as Cox Crossing

TREATMENT SITE PHOTOS TAKEN 10/3/2007

Traveling East on SR 2241 (Ivy Rd)

Traveling West on SR 2214 (Ivy Rd)

Traveling North on NC 43

Traveling North on NC 43

Traveling South on NC 43

Traveling South on NC 43

Sight Distance Traveling WB SR 2241 looking South

Sight Distance Traveling EB SR 2241 looking South

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 43 at SR 2241 BY: JBS
COUNTY: Pitt DATE: 12/17/2007
FILE NO.: SS 02-00-228 NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - "Vehicle Entering When Flashing"

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$20,000	10	0.149	$2,981
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$20,000	10	0.149	$2,981

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $400
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $350

TOTAL ANNUAL COST= $3,731
TOTAL COST OF PROJECT= $20,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

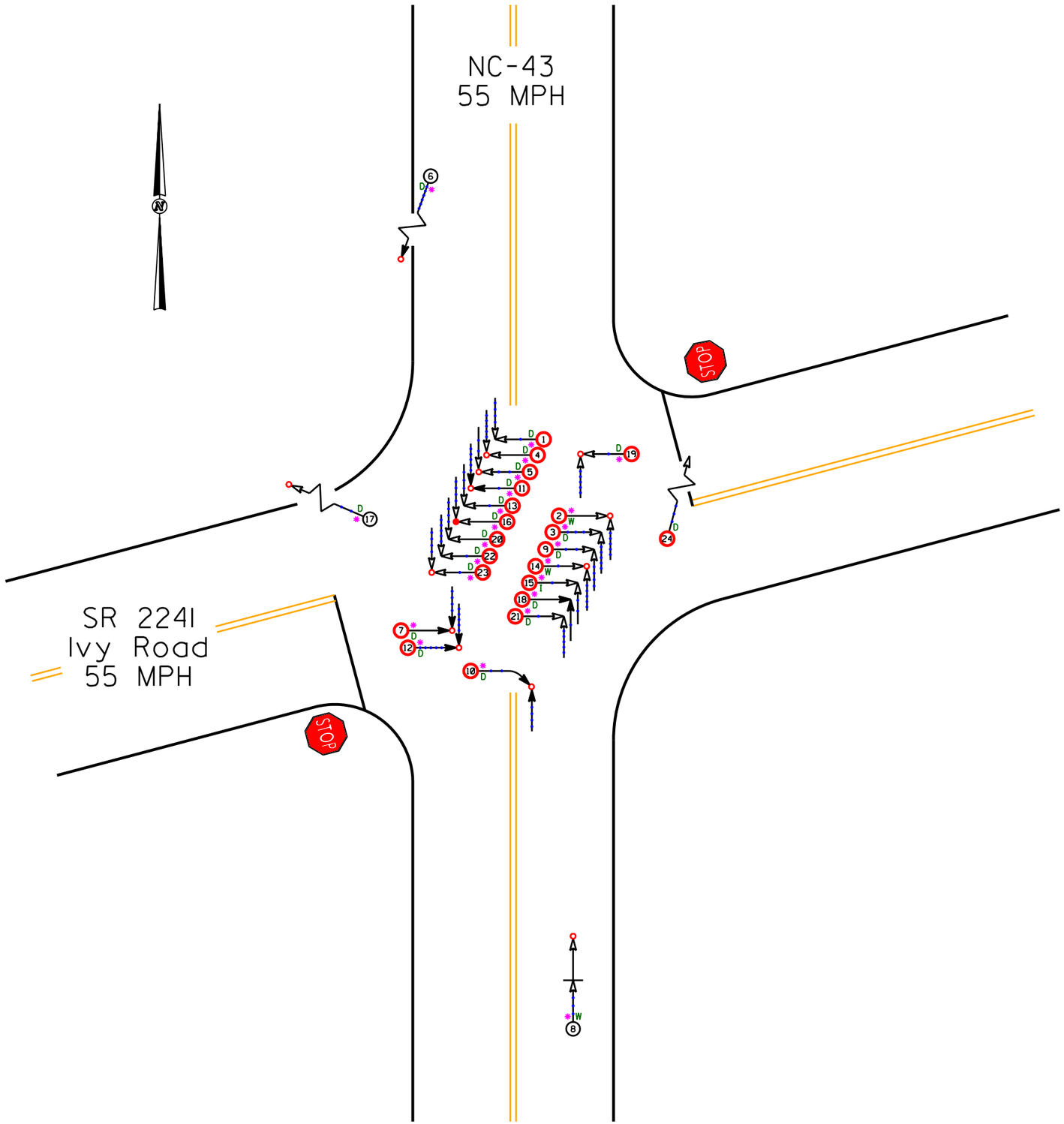
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.00	2	0.40	12	2.40	10	2.00	$251,000
AFTER	5.00	0	0.00	11	2.20	11	2.20	$48,180

Annual Benefits from Crash Cost Savings $202,820

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $199,089

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 54.37

TOTAL COST OF PROJECT - $20,000 COMPREHENSIVE B/C RATIO - 54.37



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 02-00-228
Pitt County
Cox Crossing
BEFORE Period
5/1/97 - 4/30/02
NC-43 at SR 2241

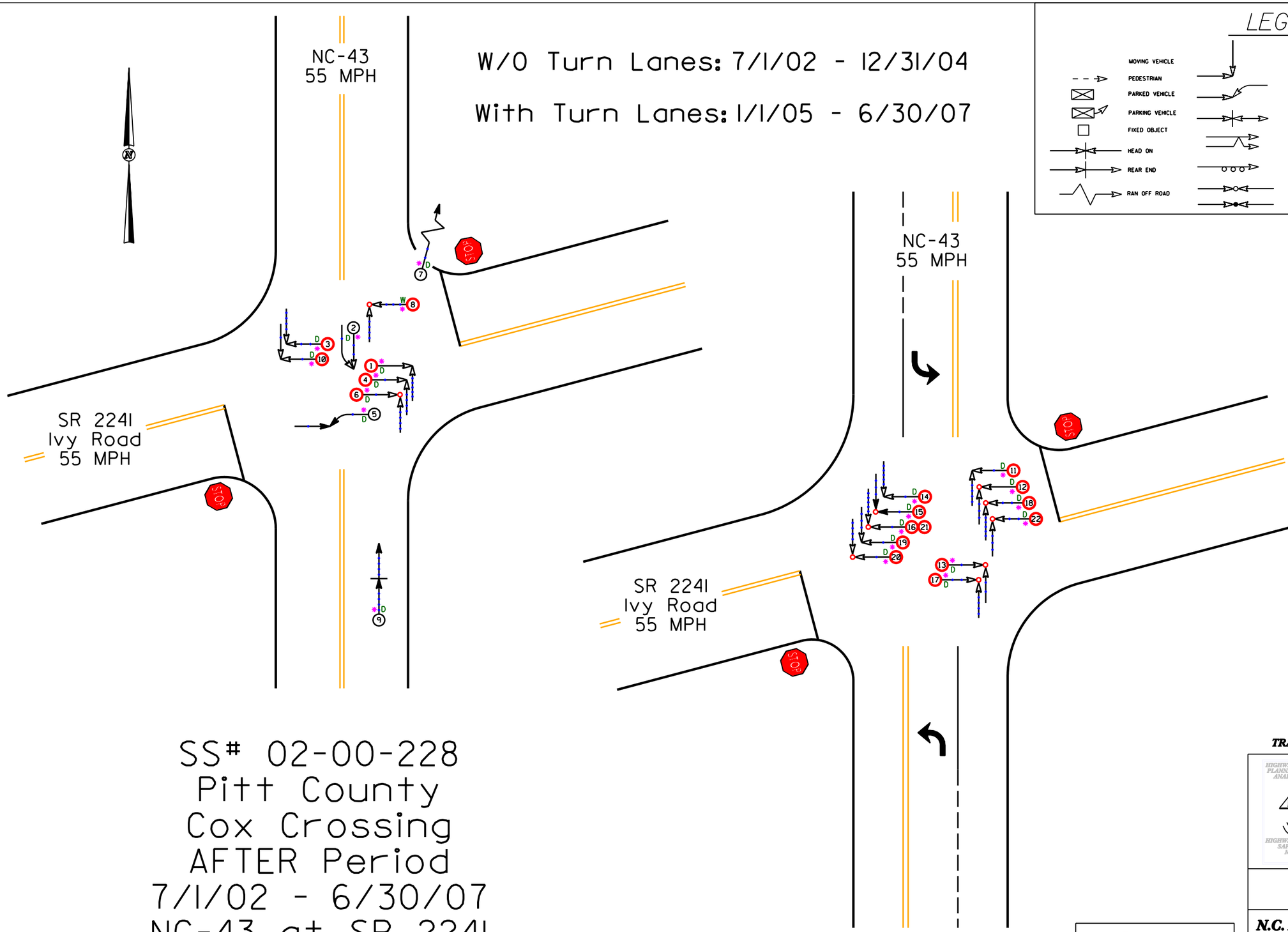
Target Crashes
Frontal Impact

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY PLANNING AND ANALYSIS
HIGHWAY SAFETY IMPROVEMENT PROGRAM
HIGHWAY SAFETY MANAGEMENT
RAILROAD-HIGHWAY SAFETY MANAGEMENT

COLLISION DIAGRAM	
DIVISION: 2	AREA:
STUDY PERIOD: 5/1/1997 to 4/30/2002	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 12-13-2007	
LOG NUMBER: SS# 02-00-228	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH



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NC-43 Approaches

Ivy Rd Approaches

SS# 02-00-228
Pitt County
Cox Crossing
AFTER Period
7/1/02 - 6/30/07
NC-43 at SR 2241

Target Crashes
Frontal Impact

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 2	AREA:
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ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 12-16-2007	
LOG NUMBER: SS# 02-00-228	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH